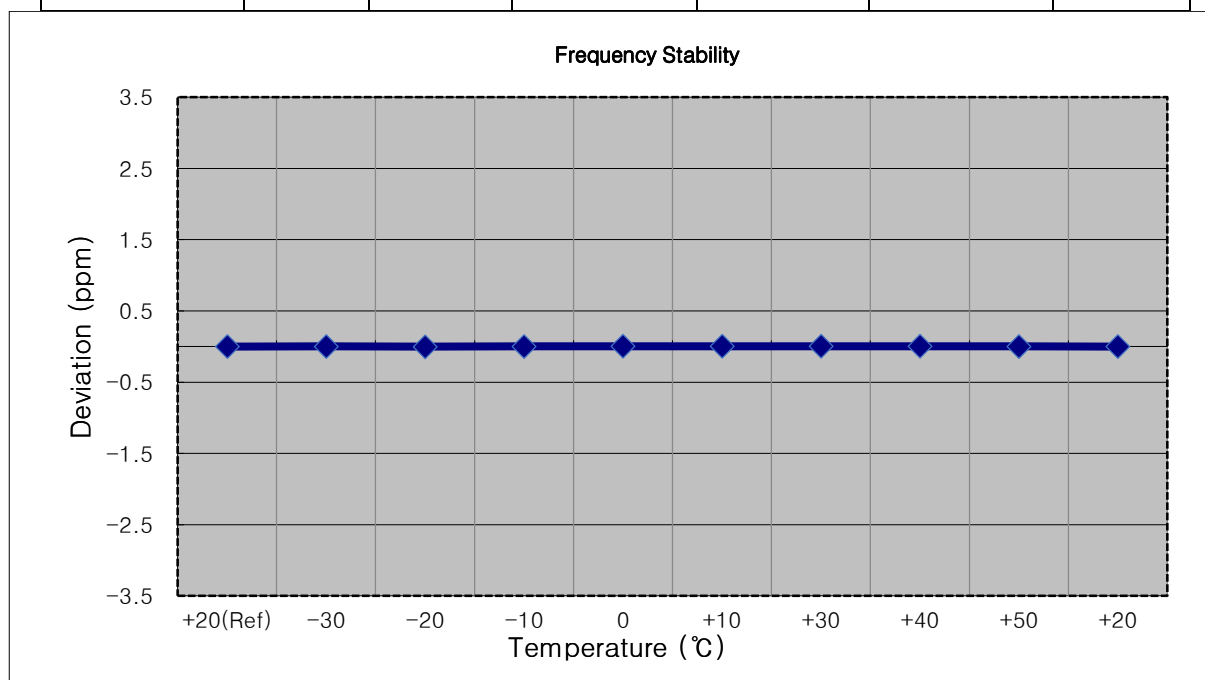


8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

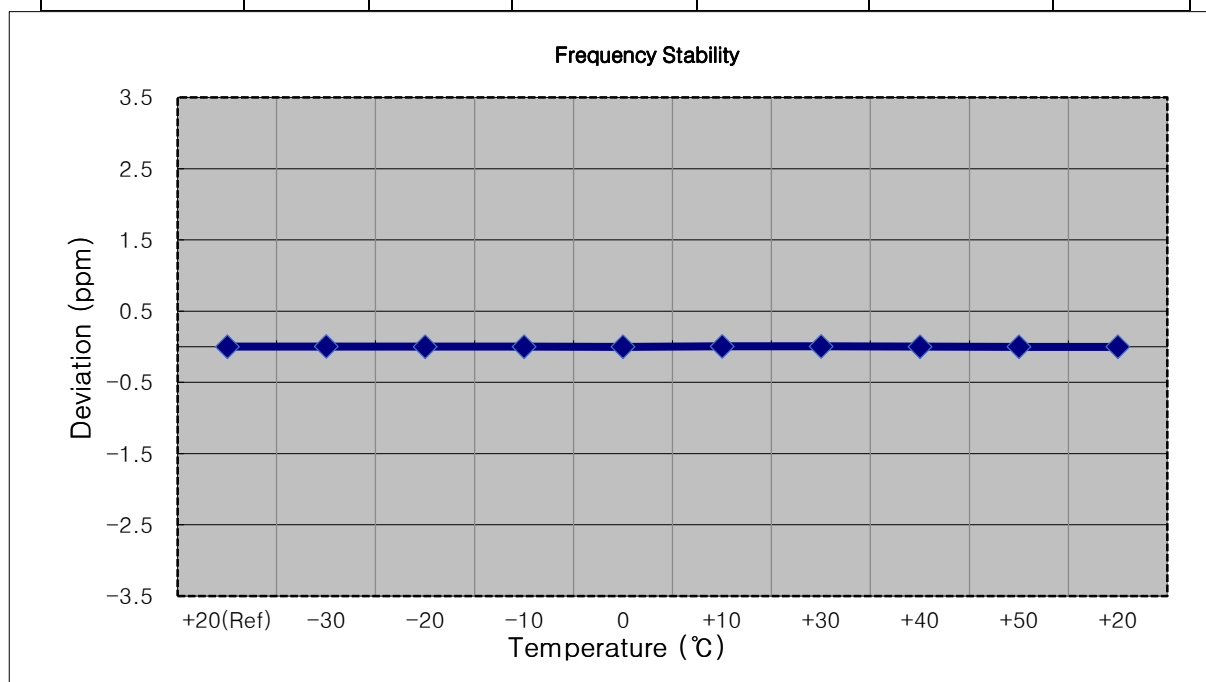
- MODE: LTE 41
- OPERATING FREQUENCY: 2498,500,000 Hz
- BANDWIDTH: 39675 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2498 499 995	0.0	0.000 000	0.000
100%		-30	2498 500 002	7.7	0.000 000	0.003
100%		-20	2498 499 988	-7.1	0.000 000	-0.003
100%		-10	2498 500 001	6.5	0.000 000	0.003
100%		0	2498 500 005	10.7	0.000 000	0.004
100%		+10	2498 500 009	14.4	0.000 001	0.006
100%		+30	2498 500 007	11.9	0.000 000	0.005
100%		+40	2498 500 005	10.1	0.000 000	0.004
100%		+50	2498 500 001	6.1	0.000 000	0.002
85%	3.400	+20	2498 499 998	3.1	0.000 000	0.001



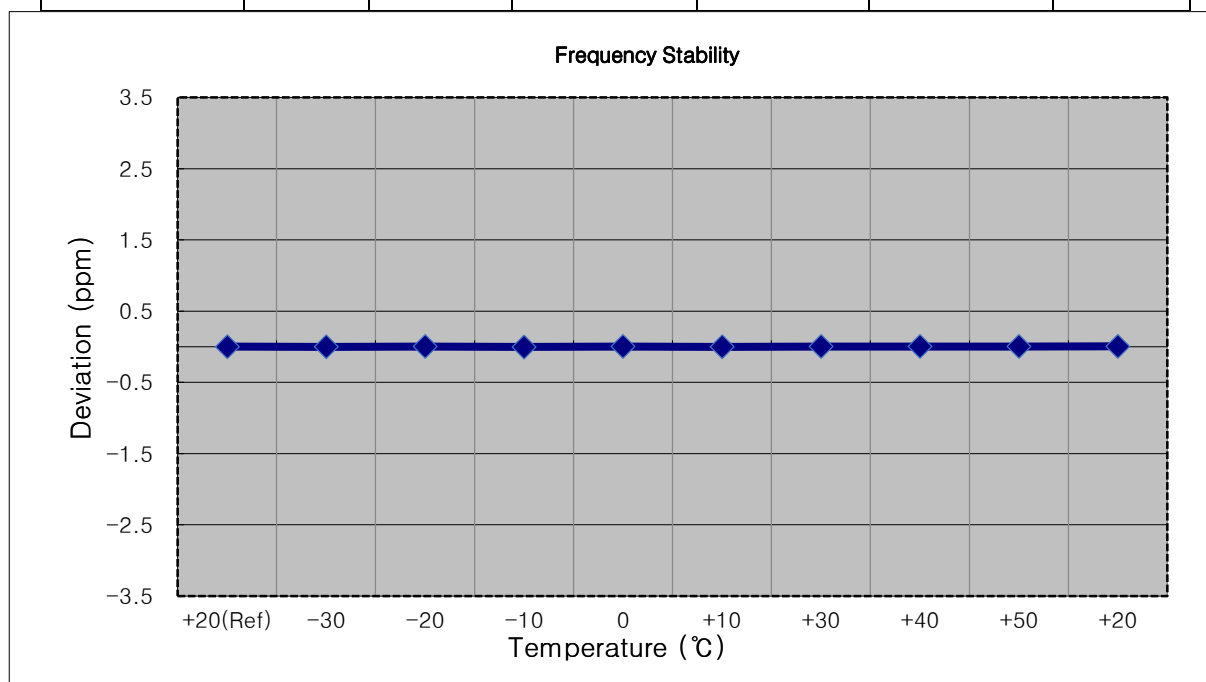
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2501,000,000 Hz
- ▣ BANDWIDTH: 39700 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2500 999 995	0.0	0.000 000	0.000
100%		-30	2501 000 001	6.2	0.000 000	0.002
100%		-20	2501 000 000	5.4	0.000 000	0.002
100%		-10	2501 000 000	5.6	0.000 000	0.002
100%		0	2500 999 990	-5.2	0.000 000	-0.002
100%		+10	2501 000 008	13.0	0.000 001	0.005
100%		+30	2501 000 007	12.1	0.000 000	0.005
100%		+40	2500 999 998	3.0	0.000 000	0.001
100%		+50	2500 999 990	-4.7	0.000 000	-0.002
85%	3.400	+20	2500 999 992	-3.2	0.000 000	-0.001



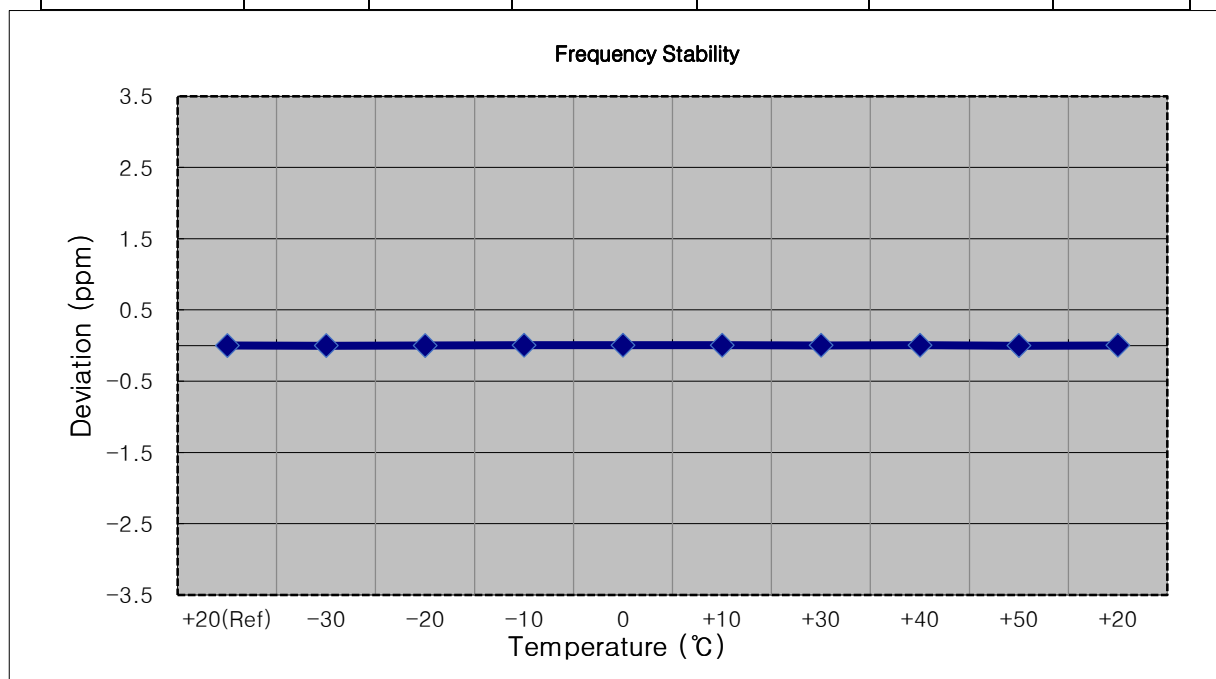
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2503,500,000 Hz
- ▣ BANDWIDTH: 39725 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2503 499 995	0.0	0.000 000	0.000
100%		-30	2503 499 990	-4.8	0.000 000	-0.002
100%		-20	2503 500 005	10.4	0.000 000	0.004
100%		-10	2503 499 988	-6.6	0.000 000	-0.003
100%		0	2503 500 004	9.4	0.000 000	0.004
100%		+10	2503 499 991	-3.4	0.000 000	-0.001
100%		+30	2503 500 004	9.7	0.000 000	0.004
100%		+40	2503 500 004	9.6	0.000 000	0.004
100%		+50	2503 500 006	11.0	0.000 000	0.004
85%	3.400	+20	2503 500 007	11.9	0.000 000	0.005



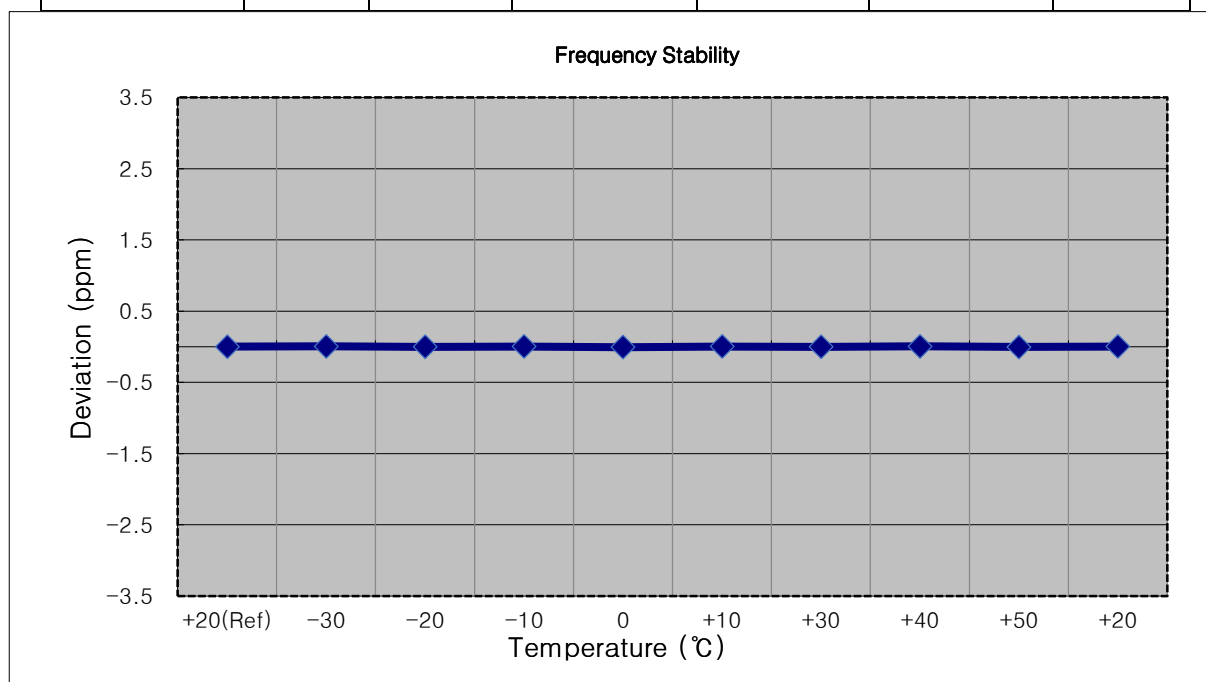
■ MODE: LTE 41
 ■ OPERATING FREQUENCY: 2506,000,000 Hz
 ■ BANDWIDTH: 39750 (20 MHz)
 ■ REFERENCE VOLTAGE: 3.85 VDC
 ■ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2506 000 008	0.0	0.000 000	0.000
100%		-30	2506 000 003	-5.0	0.000 000	-0.002
100%		-20	2506 000 010	2.3	0.000 000	0.001
100%		-10	2506 000 016	8.3	0.000 000	0.003
100%		0	2506 000 018	9.7	0.000 000	0.004
100%		+10	2506 000 019	11.2	0.000 000	0.004
100%		+30	2506 000 013	5.2	0.000 000	0.002
100%		+40	2506 000 019	10.7	0.000 000	0.004
100%		+50	2506 000 002	-5.7	0.000 000	-0.002
85%	3.400	+20	2506 000 013	5.2	0.000 000	0.002



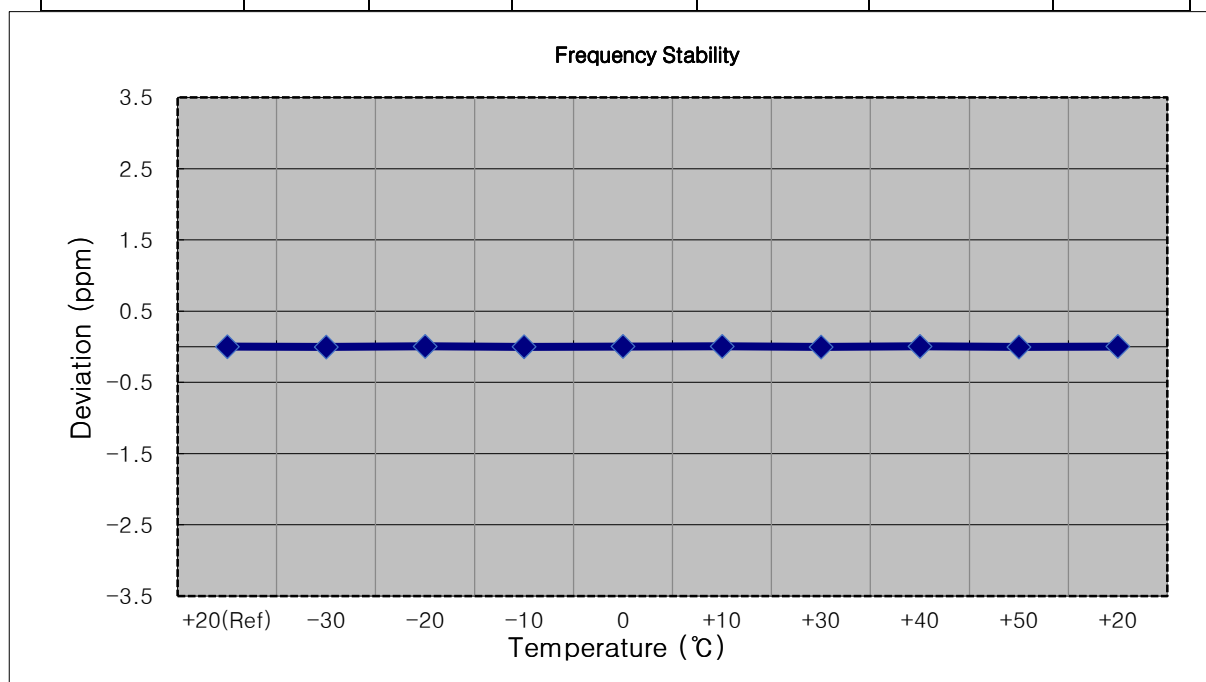
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 994	0.0	0.000 000	0.000
100%		-30	2593 000 006	12.0	0.000 000	0.005
100%		-20	2592 999 989	-4.3	0.000 000	-0.002
100%		-10	2593 000 001	7.4	0.000 000	0.003
100%		0	2592 999 981	-12.9	0.000 000	-0.005
100%		+10	2593 000 000	6.6	0.000 000	0.003
100%		+30	2592 999 989	-5.0	0.000 000	-0.002
100%		+40	2593 000 007	13.5	0.000 001	0.005
100%		+50	2592 999 986	-7.4	0.000 000	-0.003
85%	3.400	+20	2593 000 000	5.9	0.000 000	0.002



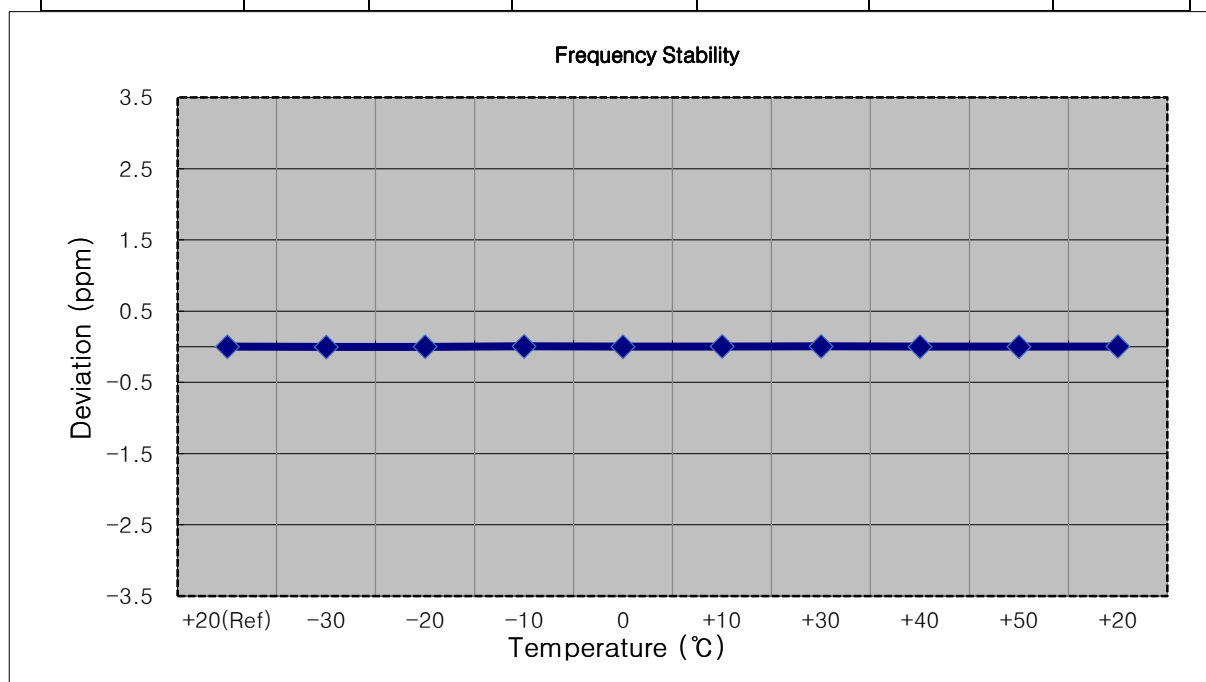
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 006	0.0	0.000 000	0.000
100%		-30	2593 000 000	-5.9	0.000 000	-0.002
100%		-20	2593 000 018	12.8	0.000 000	0.005
100%		-10	2593 000 002	-3.4	0.000 000	-0.001
100%		0	2593 000 013	7.4	0.000 000	0.003
100%		+10	2593 000 018	11.9	0.000 000	0.005
100%		+30	2592 999 997	-8.8	0.000 000	-0.003
100%		+40	2593 000 018	11.9	0.000 000	0.005
100%		+50	2592 999 999	-6.4	0.000 000	-0.002
85%	3.400	+20	2593 000 014	8.1	0.000 000	0.003



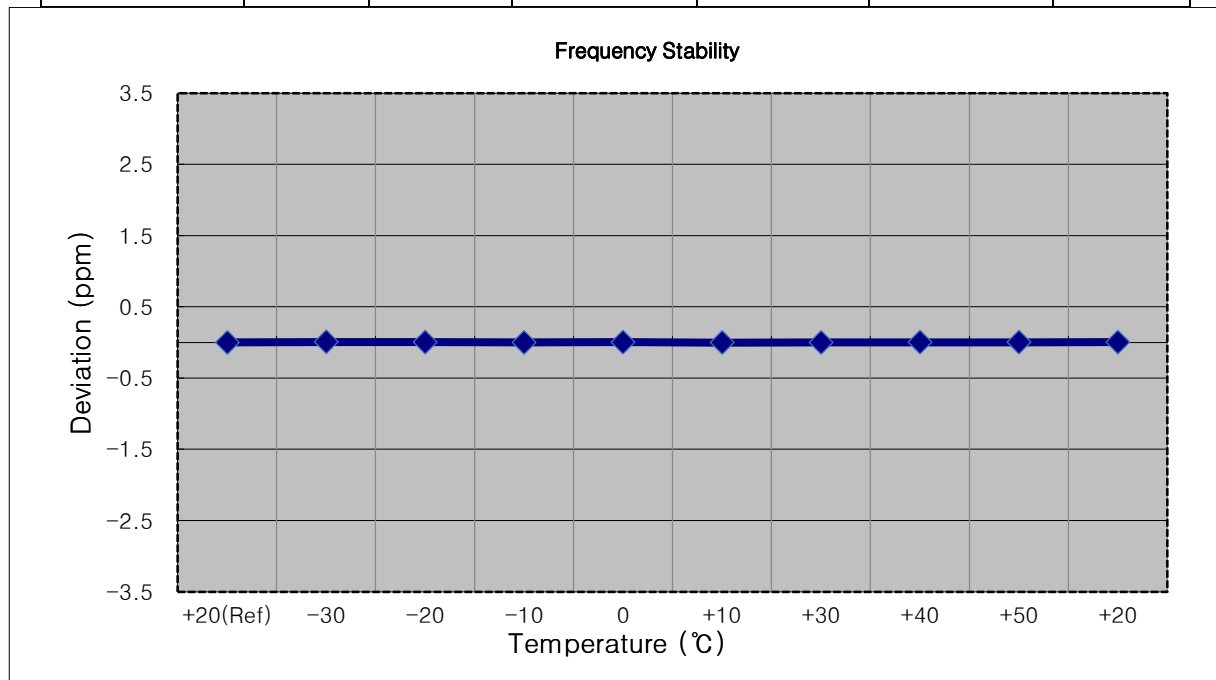
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 011	0.0	0.000 000	0.000
100%		-30	2593 000 003	-8.1	0.000 000	-0.003
100%		-20	2593 000 007	-4.2	0.000 000	-0.002
100%		-10	2593 000 026	14.9	0.000 001	0.006
100%		0	2593 000 014	3.0	0.000 000	0.001
100%		+10	2593 000 021	9.8	0.000 000	0.004
100%		+30	2593 000 027	16.5	0.000 001	0.006
100%		+40	2593 000 015	3.8	0.000 000	0.001
100%		+50	2593 000 017	5.7	0.000 000	0.002
85%	3.400	+20	2593 000 021	10.4	0.000 000	0.004



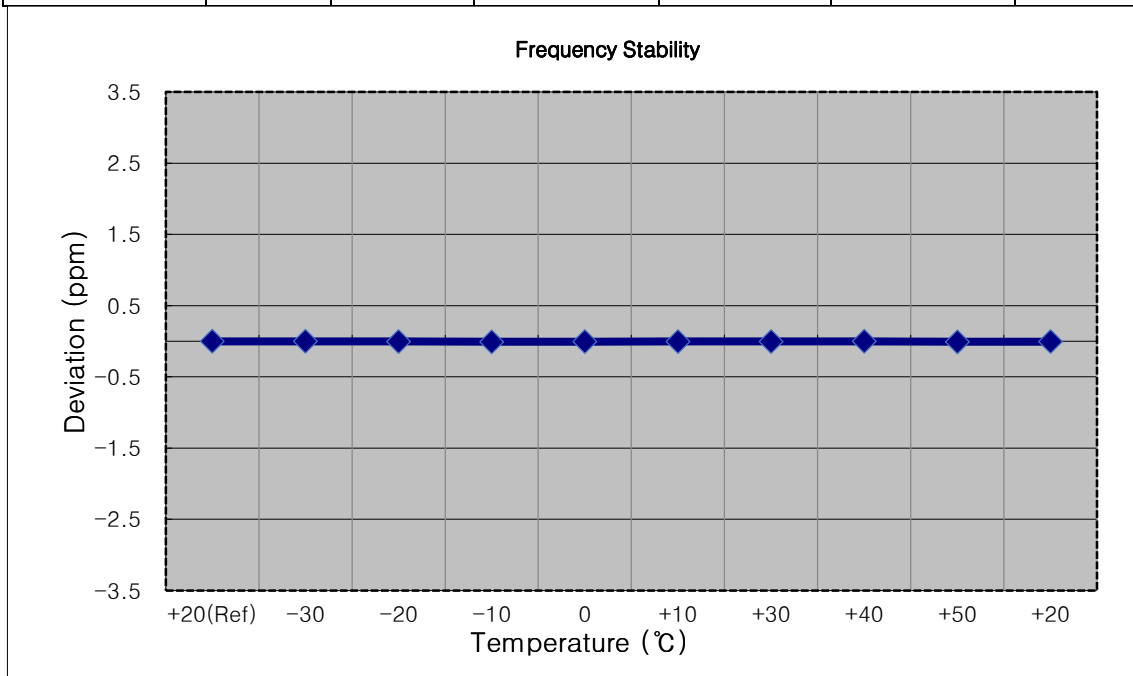
MODE:	<u>LTE 41</u>
OPERATING FREQUENCY:	<u>2593,000,000 Hz</u>
BANDWIDTH:	<u>40620 (20 MHz)</u>
REFERENCE VOLTAGE:	<u>3.85 VDC</u>
DEVIATION LIMIT:	<u>Emission must remain in band</u>

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 011	0.0	0.000 000	0.000
100%		-30	2593 000 027	16.1	0.000 001	0.006
100%		-20	2593 000 018	7.7	0.000 000	0.003
100%		-10	2593 000 006	-4.7	0.000 000	-0.002
100%		0	2593 000 021	10.4	0.000 000	0.004
100%		+10	2593 000 003	-7.6	0.000 000	-0.003
100%		+30	2593 000 006	-4.6	0.000 000	-0.002
100%		+40	2593 000 015	4.0	0.000 000	0.002
100%		+50	2593 000 017	6.4	0.000 000	0.002
85%	3.400	+20	2593 000 022	11.7	0.000 000	0.005



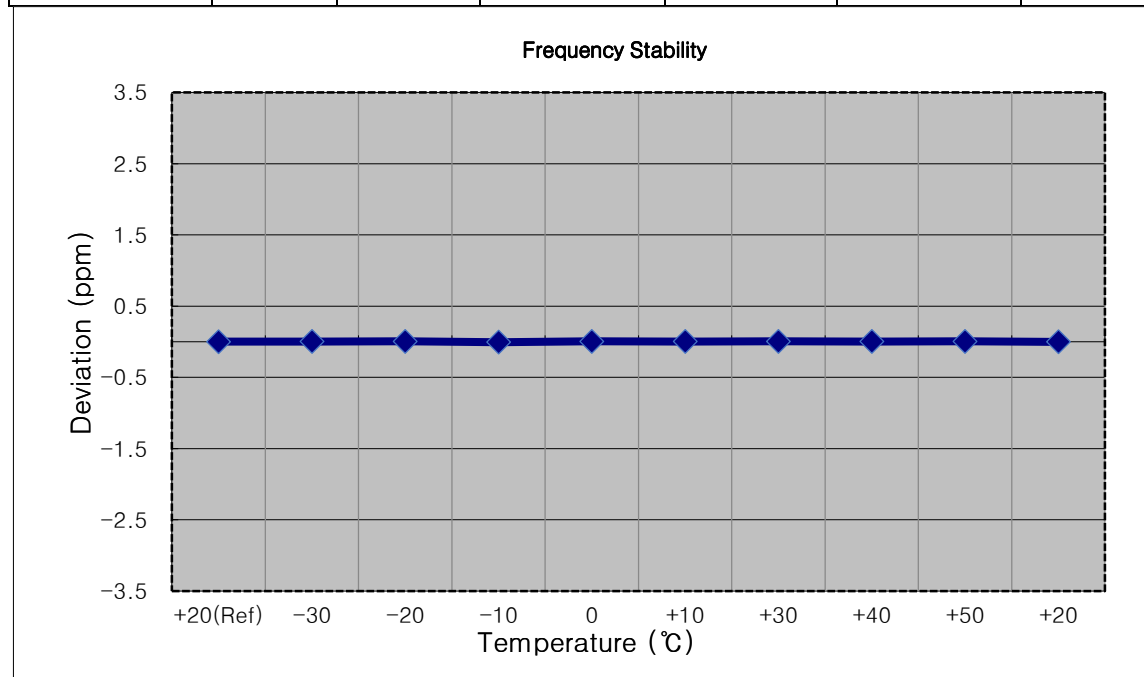
- MODE: LTE 41
- OPERATING FREQUENCY: 2687,500,000 Hz
- BANDWIDTH: 41565 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2687 499 980	0.0	0.000 000	0.000
100%		-30	2687 499 974	-5.4	0.000 000	-0.002
100%		-20	2687 499 971	-9.0	0.000 000	-0.003
100%		-10	2687 499 960	-19.3	-0.000 001	-0.007
100%		0	2687 499 965	-15.1	-0.000 001	-0.006
100%		+10	2687 499 969	-10.2	0.000 000	-0.004
100%		+30	2687 499 973	-6.9	0.000 000	-0.003
100%		+40	2687 499 977	-2.8	0.000 000	-0.001
100%		+50	2687 499 961	-19.0	-0.000 001	-0.007
85%	3.400	+20	2687 499 962	-17.9	-0.000 001	-0.007



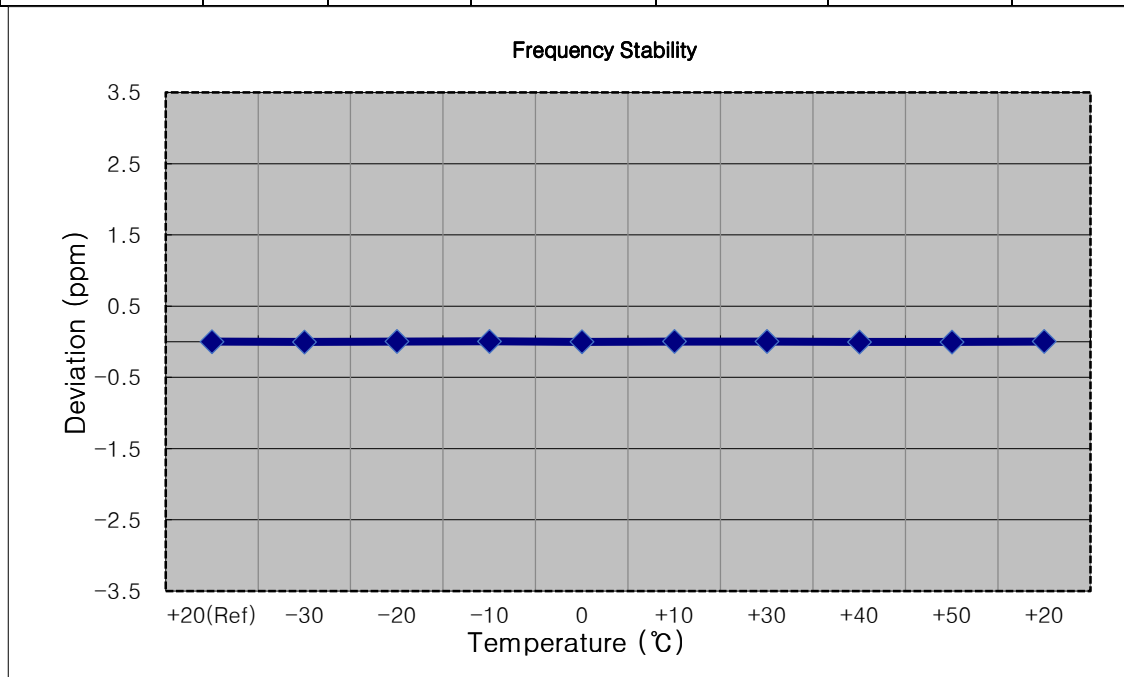
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2685,000,000 Hz
- ▣ BANDWIDTH: 41540 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2685 000 004	0.0	0.000 000	0.000
100%		-30	2685 000 014	9.8	0.000 000	0.004
100%		-20	2685 000 016	12.3	0.000 000	0.005
100%		-10	2684 999 991	-13.2	0.000 000	-0.005
100%		0	2685 000 016	12.1	0.000 000	0.005
100%		+10	2685 000 016	11.7	0.000 000	0.004
100%		+30	2685 000 018	13.6	0.000 001	0.005
100%		+40	2685 000 014	10.1	0.000 000	0.004
100%		+50	2685 000 018	14.3	0.000 001	0.005
85%	3.400	+20	2685 000 001	-3.3	0.000 000	-0.001



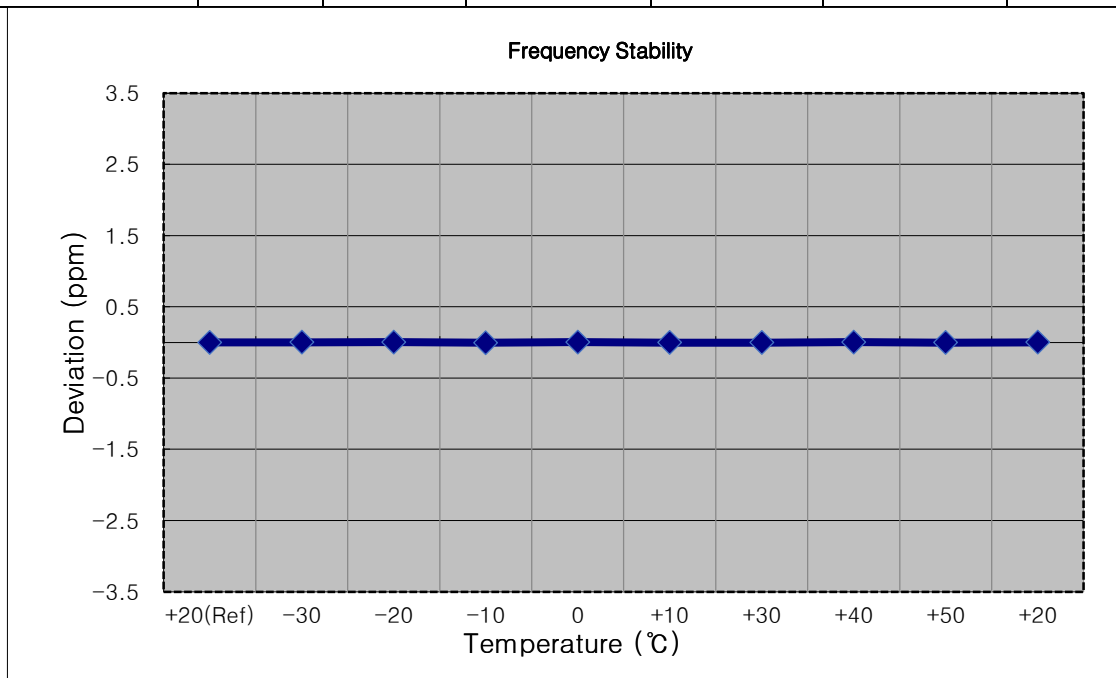
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2682,500,000 Hz
- ▣ BANDWIDTH: 41515 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2682 499 998	0.0	0.000 000	0.000
100%		-30	2682 499 990	-7.8	0.000 000	-0.003
100%		-20	2682 500 007	9.3	0.000 000	0.003
100%		-10	2682 500 011	13.8	0.000 001	0.005
100%		0	2682 499 993	-4.2	0.000 000	-0.002
100%		+10	2682 500 004	6.1	0.000 000	0.002
100%		+30	2682 500 008	10.4	0.000 000	0.004
100%		+40	2682 499 987	-10.3	0.000 000	-0.004
100%		+50	2682 499 990	-7.7	0.000 000	-0.003
85%	3.400	+20	2682 500 007	9.2	0.000 000	0.003



MODE:	<u>LTE 41</u>
OPERATING FREQUENCY:	<u>2680,000,000 Hz</u>
BANDWIDTH:	<u>41490 (20 MHz)</u>
REFERENCE VOLTAGE:	<u>3.85 VDC</u>
DEVIATION LIMIT:	<u>Emission must remain in band</u>

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2679 999 991	0.0	0.000 000	0.000
100%		-30	2679 999 996	5.0	0.000 000	0.002
100%		-20	2680 000 002	11.2	0.000 000	0.004
100%		-10	2679 999 979	-11.4	0.000 000	-0.004
100%		0	2680 000 002	11.5	0.000 000	0.004
100%		+10	2679 999 983	-7.6	0.000 000	-0.003
100%		+30	2679 999 983	-7.8	0.000 000	-0.003
100%		+40	2680 000 003	11.8	0.000 000	0.004
100%		+50	2679 999 982	-9.1	0.000 000	-0.003
85%	3.400	+20	2679 999 996	4.8	0.000 000	0.002



8.8 GEO-LOCATION MECHANISM

The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

The validation of this mechanism is provided below. The device was configured for cellular communications to a test set and the MCC code was adjusted on the test set between the US MCC and then an MCC code valid for a country where the LTE band is supported.

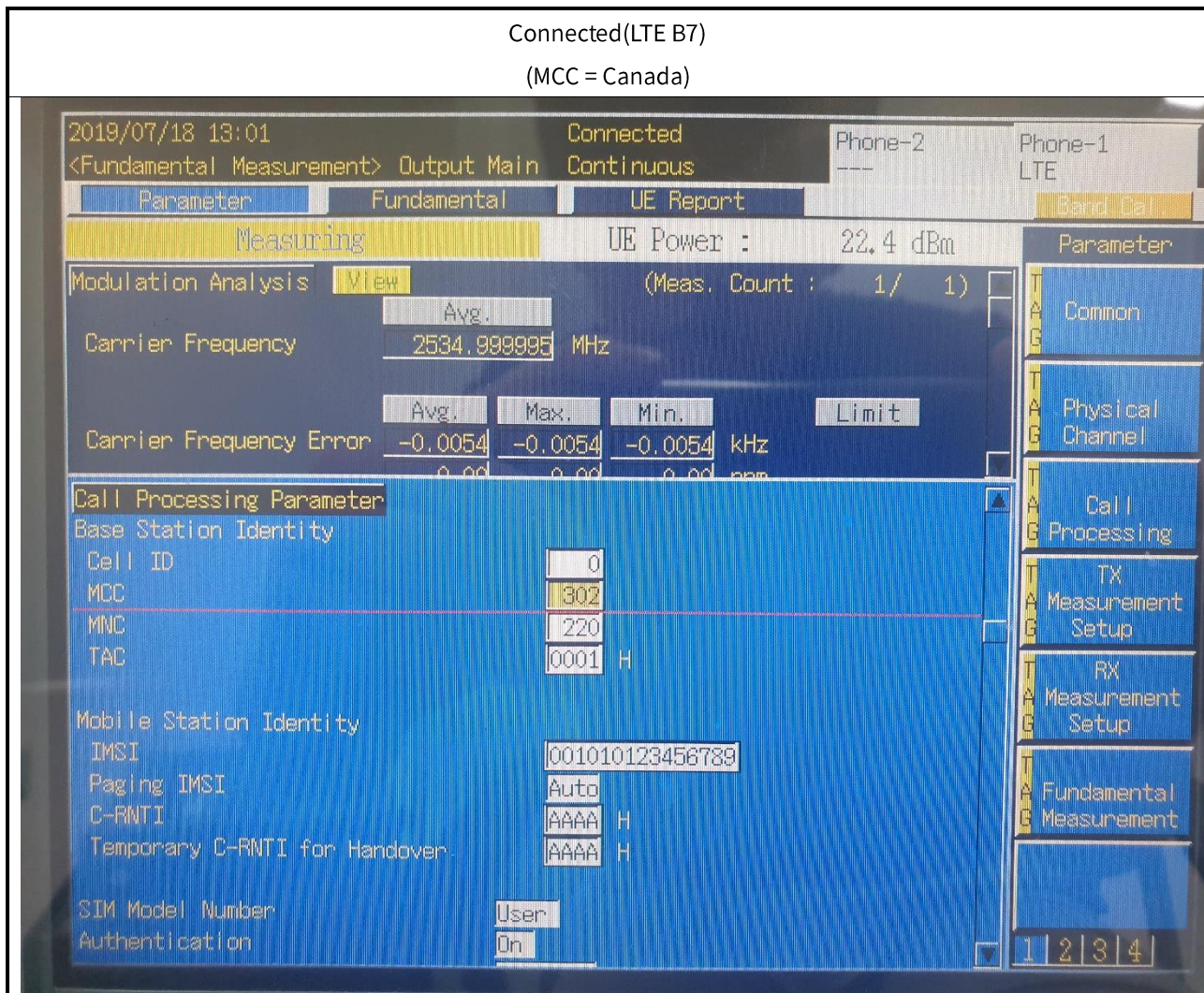
Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)
38	Did not connect	Connected (Canada)
40	Did not connect	Connected (Canada)
41	Connected	Connected (Canada)

The verification tests confirmed the operational of the geo-location mechanism.

Verification test

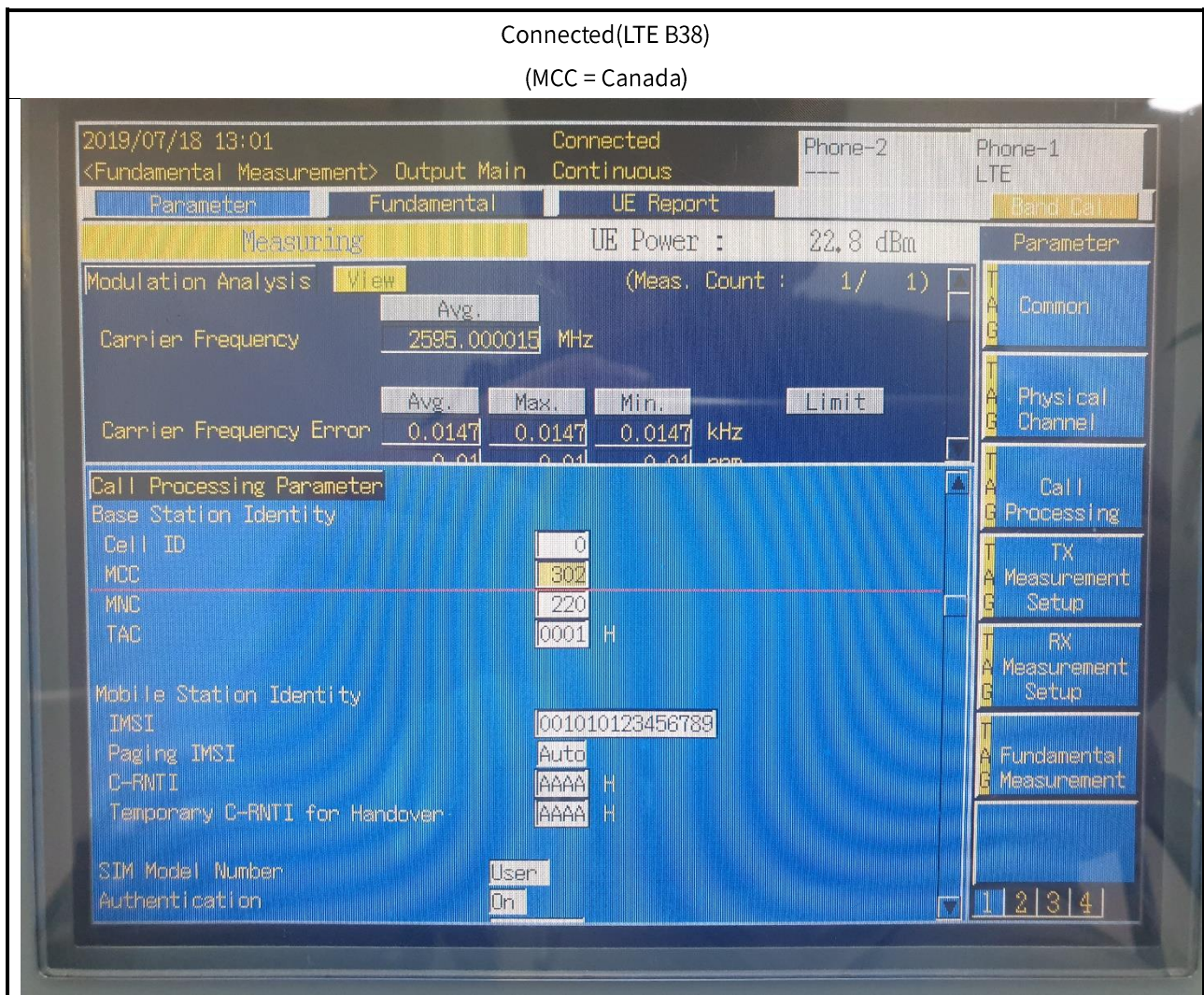
Connected(LTE B7)

(MCC = Canada)



Connected(LTE B38)

(MCC = Canada)



Connected(LTE B40)

(MCC = Canada)

2019/07/18 13:00

Connected

Phone-2

Phone-1

<Fundamental Measurement>

Output Main

Continuous

LTE

Parameter

Fundamental

UE Report

Band Cal.

Measuring

UE Power : 22.9 dBm

Parameter

Modulation Analysis

View

(Meas. Count : 1/ 1)

Avg.

Carrier Frequency

2350.000004 MHz

Avg.

Max.

Min.

Limit

Carrier Frequency Error

0.0038

0.0038

0.0038

kHz

Call Processing Parameter

Base Station Identity

Cell ID

0

MCC

302

MNC

220

TAC

0001

H

Mobile Station Identity

IMSI

001010123456789

Paging IMSI

Auto

C-RNTI

AAAA

H

Temporary C-RNTI for Handover

AAAA

H

SIM Model Number

User

Authentication

On

Common

Physical Channel

Call Processing

TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1

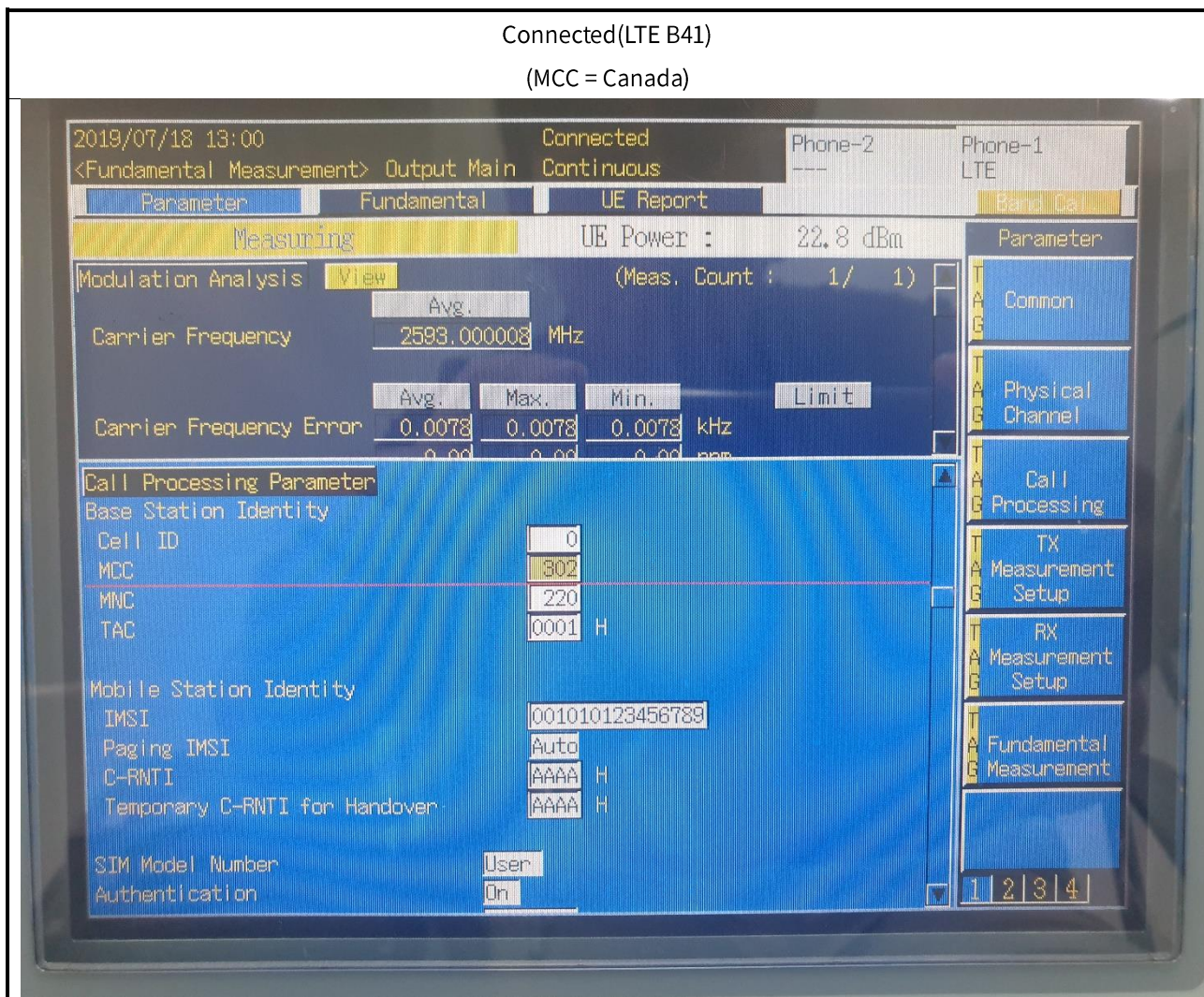
2

3

4

Connected(LTE B41)

(MCC = Canada)



Connected(LTE B41)

(MCC = US)

2019/07/18 13:03
Connected
Phone-2
Phone-1
LTE

<Fundamental Measurement> Output Main Continuous

Parameter Fundamental UE Report

Measuring UE Power : 22.8 dBm

Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency Avg. 2593.000000 MHz

Carrier Frequency Error Avg. 0.0001 Max. 0.0001 Min. 0.0001 Limit kHz

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 311

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Temporary C-RNTI for Handover AAAA H

SIM Model Number User

Authentication On

Parameter

Common

Physical Channel

Call Processing

TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1 2 3 4

Did not connect (LTE B7)

(MCC = US)

2019/07/18 13:04
Idle
Phone-2
Phone-1
<Fundamental Measurement> Output Main Continuous
LTE

Parameter
Fundamental
UE Report

Reference Signal not found
UE Power : -26.9 dBm

Modulation Analysis
View
(Meas. Count : 1/ 1)

Carrier Frequency
Avg.
MHz

Carrier Frequency Error
Avg.
Max.
Min.
Limit
kHz

Call Processing Parameter

Base Station Identity

Cell ID
0

MCC
311

MNC
01

TAC
0001 H

Mobile Station Identity

IMSI
001010123456789

Paging IMSI
Auto

C-RNTI
AAAA H

Temporary C-RNTI for Handover
AAAA H

SIM Model Number
User

Authentication
On

Parameter

Common

Physical Channel

Call Processing

TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1 2 3 4

Did not connect (LTE B38)

(MCC = US)

2019/07/18 13:04

Idle

Phone-2

Phone-1

<Fundamental Measurement> Output Main

Continuous

LTE

Parameter

Fundamental

UE Report

Band Cal.

Reference Signal not found

UE Power : -27.2 dBm

Modulation Analysis

View

(Meas. Count : 1 / 1)

Avg.

Carrier Frequency

MHz

Avg.

Max.

Min.

Limit

Carrier Frequency Error

kHz

ppm

Call Processing Parameter

Base Station Identity

Cell ID

0

MCC

311

MNC

01

TAC

0001

H

Mobile Station Identity

IMSI

001010123456789

Paging IMSI

Auto

C-RNTI

AAAA

H

Temporary C-RNTI for Handover

AAAA

H

SIM Model Number

User

Authentication

On

Parameter

Common

Physical Channel

Call Processing

TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1 2 3 4

Did not connect (LTE B40)

(MCC = US)

2019/07/18 13:04
Idle
Phone-2
Phone-1

<Fundamental Measurement> Output Main Continuous

Parameter Fundamental UE Report

Reference Signal not found
UE Power : -26.9 dBm

Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency Avg. MHz

Carrier Frequency Error Avg. Max. Min. Limit kHz

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 311

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Temporary C-RNTI for Handover AAAA H

SIM Model Number User

Authentication On

Parameter

Common

Physical Channel

Call Processing

TX Measurement Setup

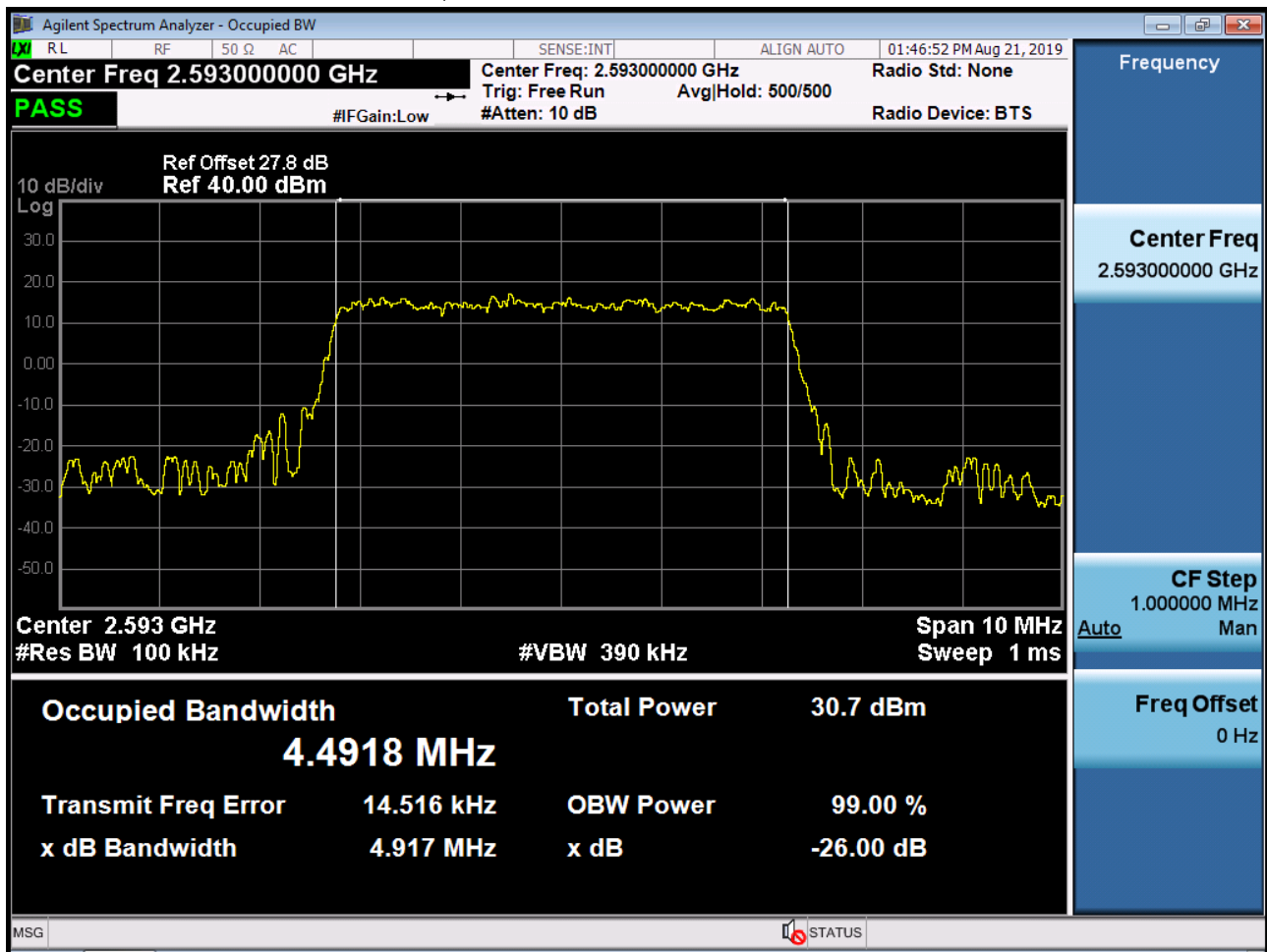
RX Measurement Setup

Fundamental Measurement

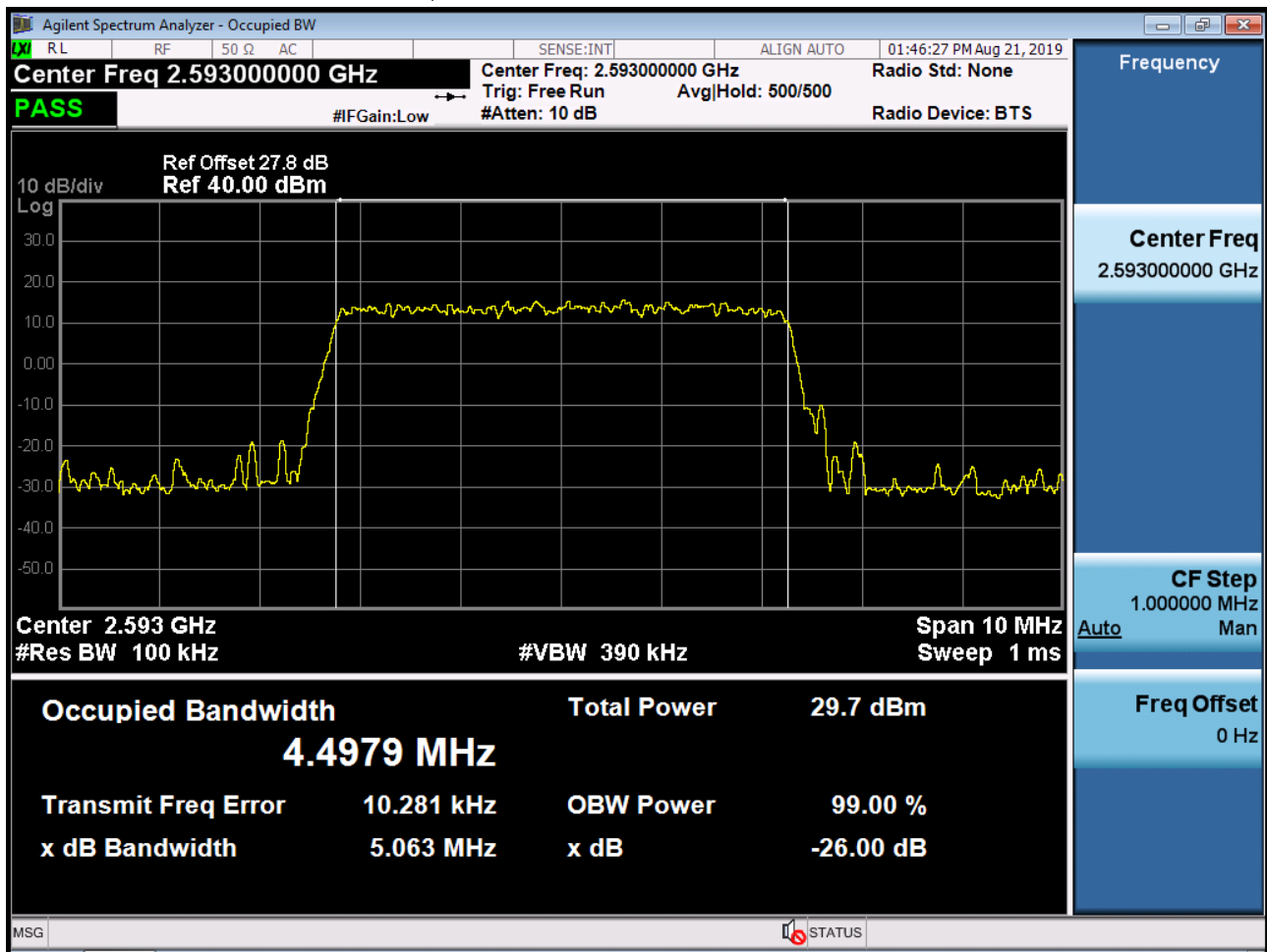
1 2 3 4

9. TEST PLOTS

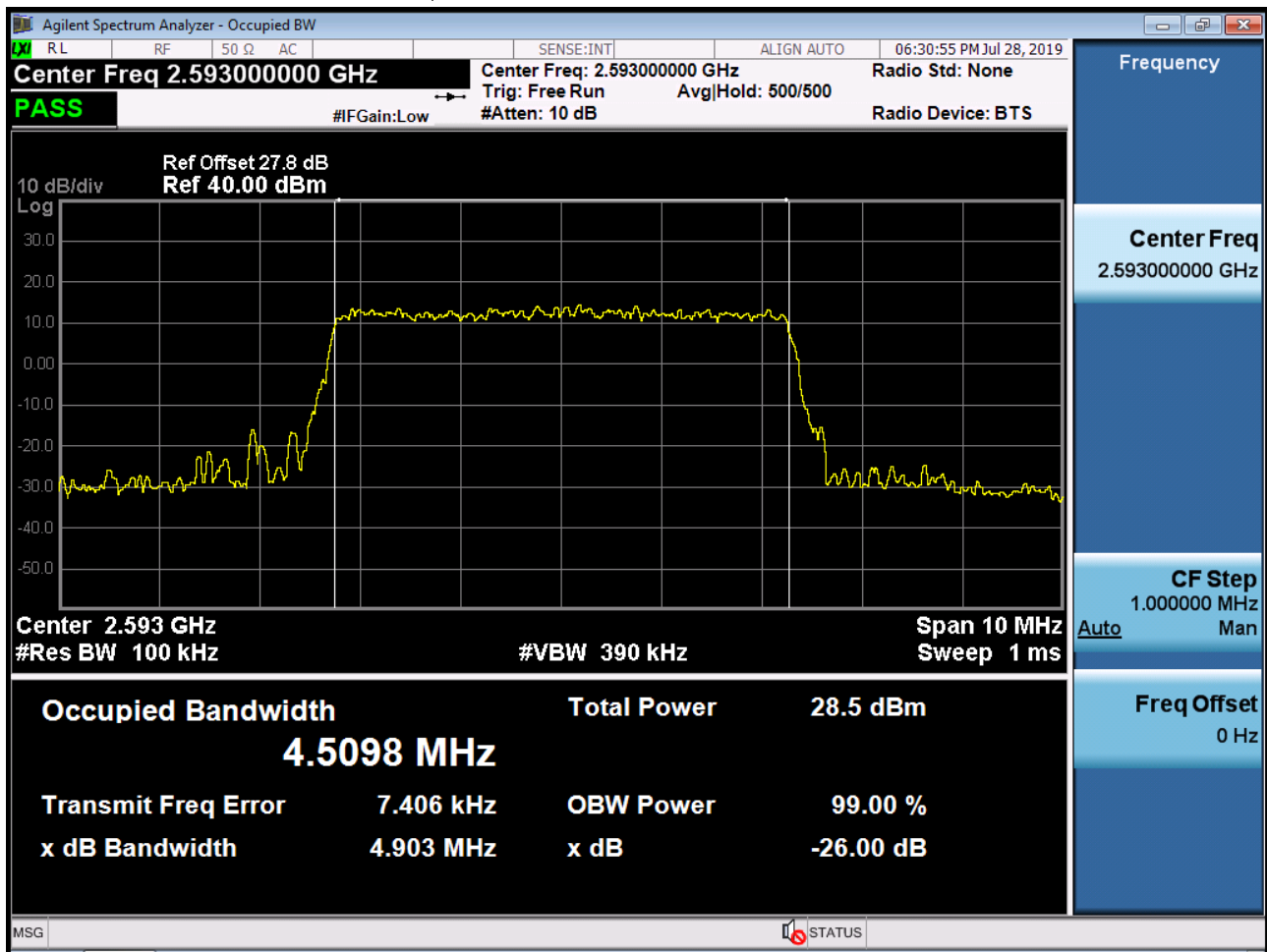
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25)



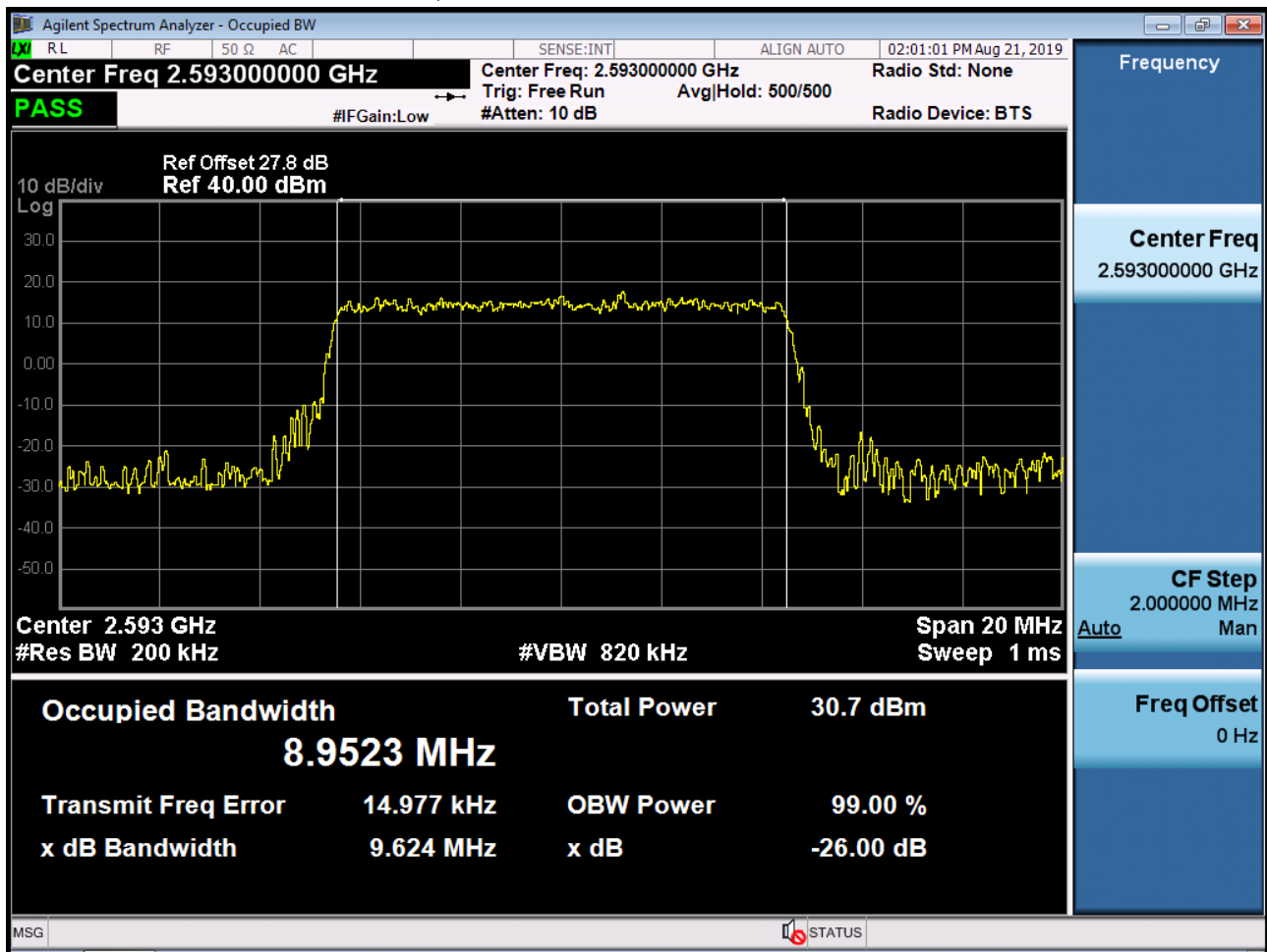
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25)



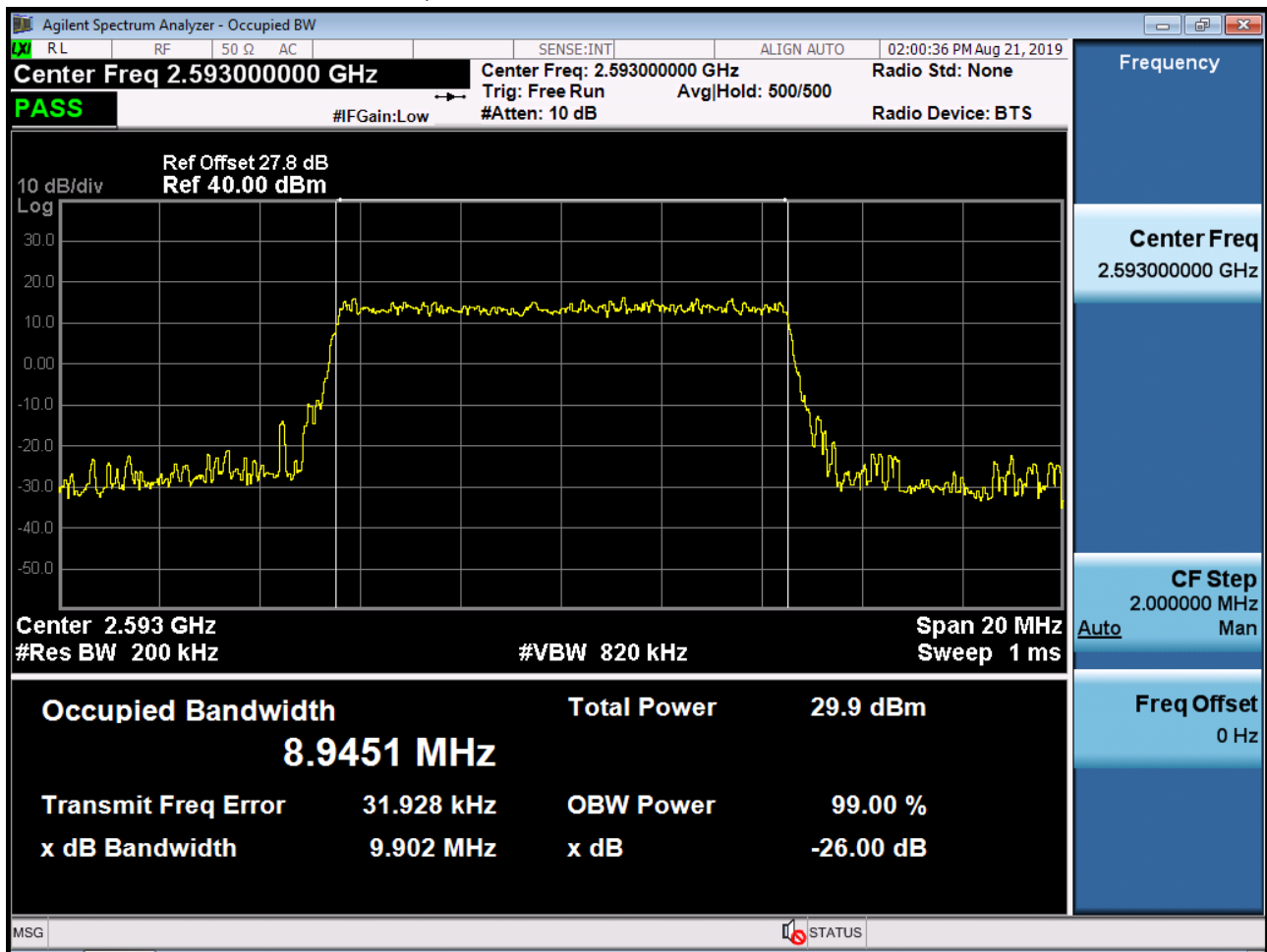
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 64-QAM RB 25)



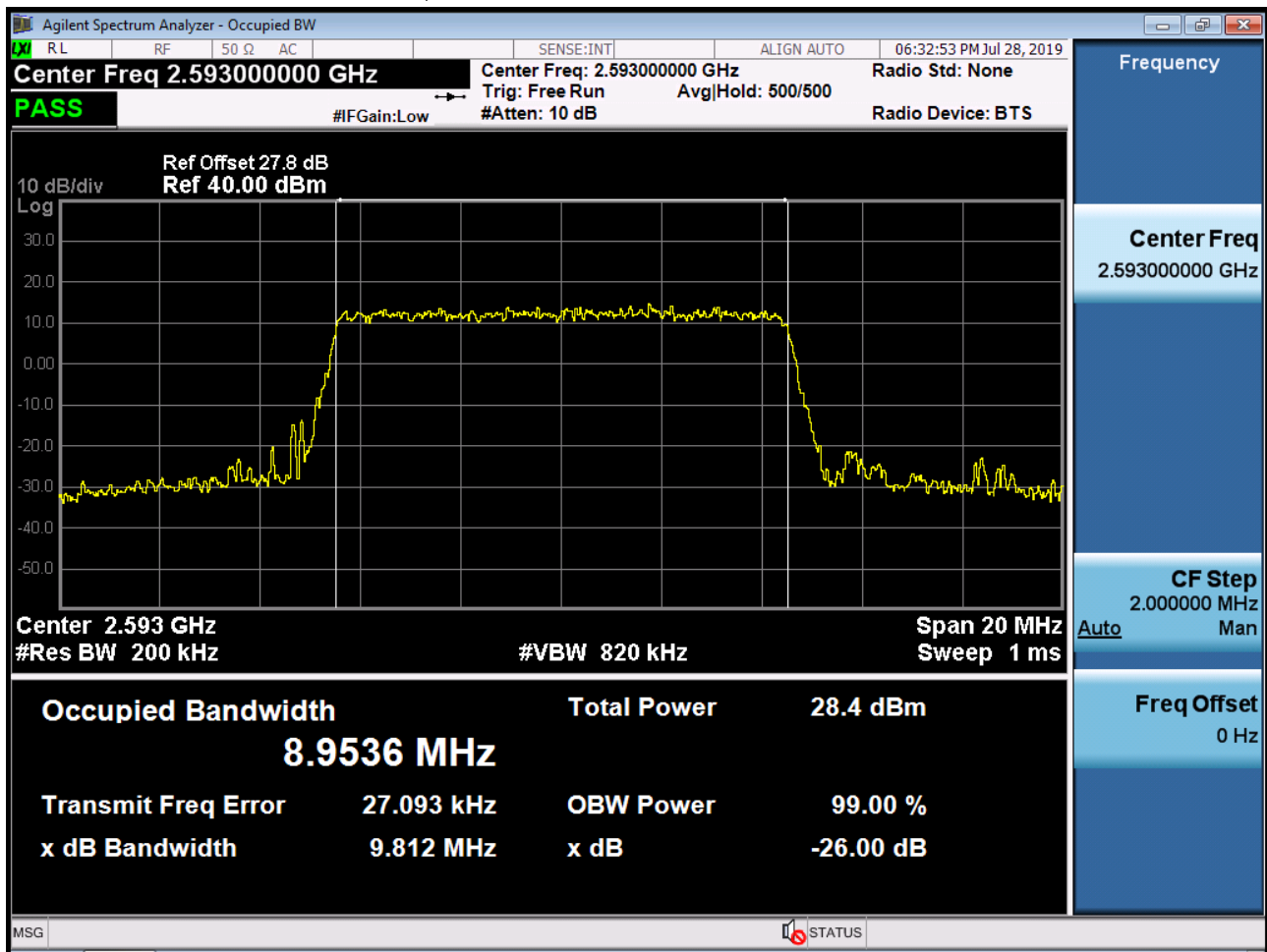
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50)



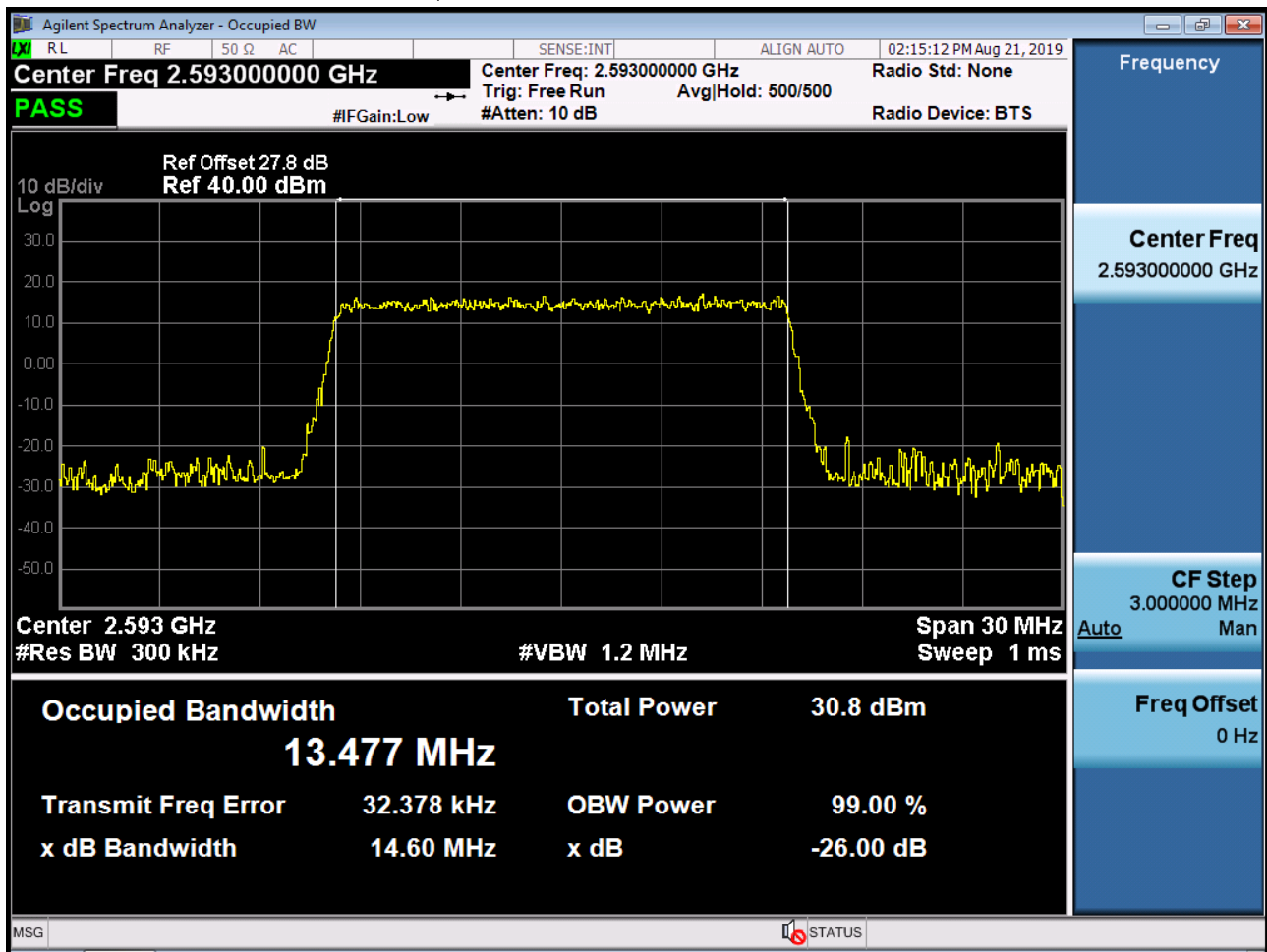
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50)



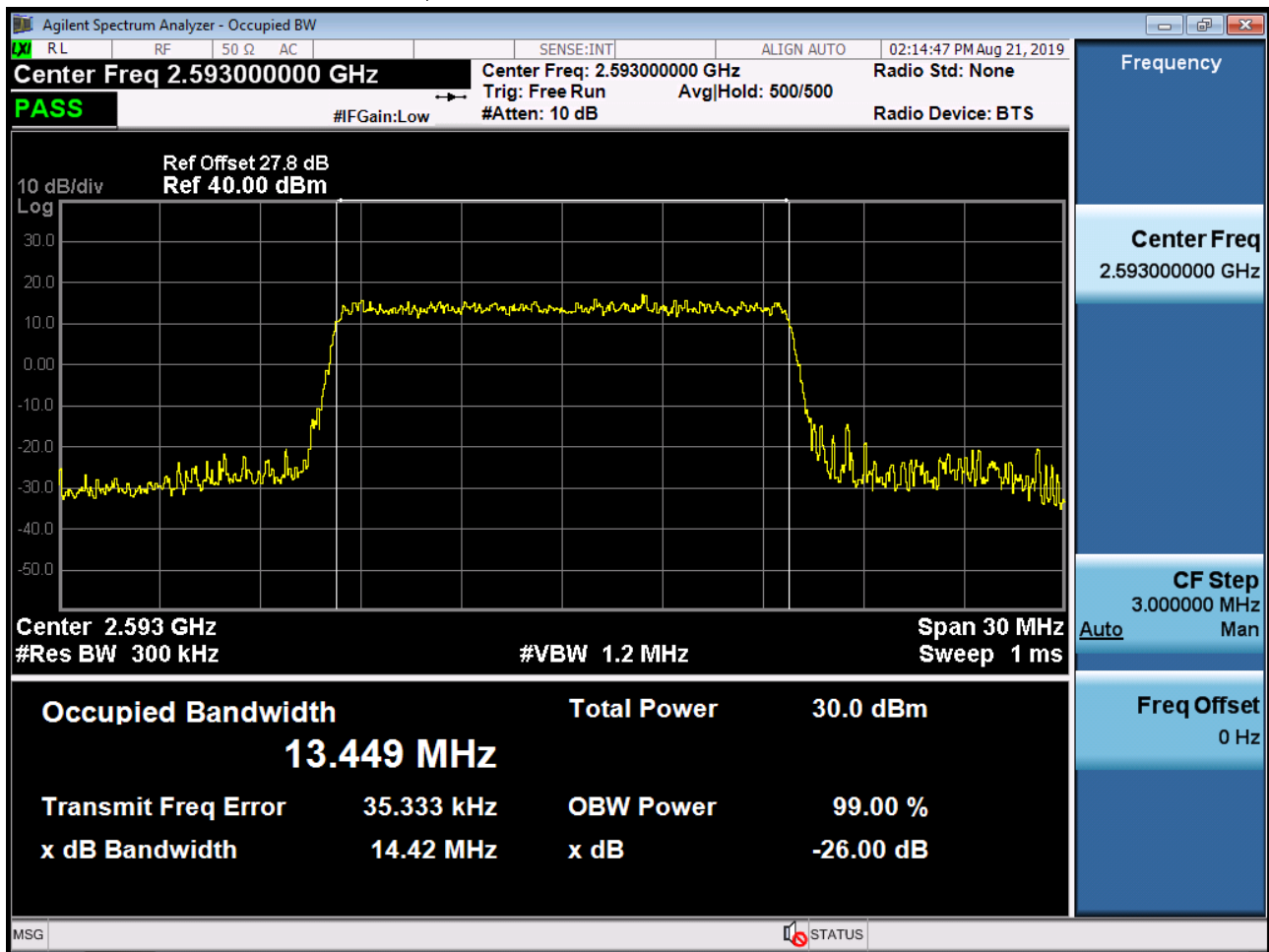
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 64-QAM RB 50)



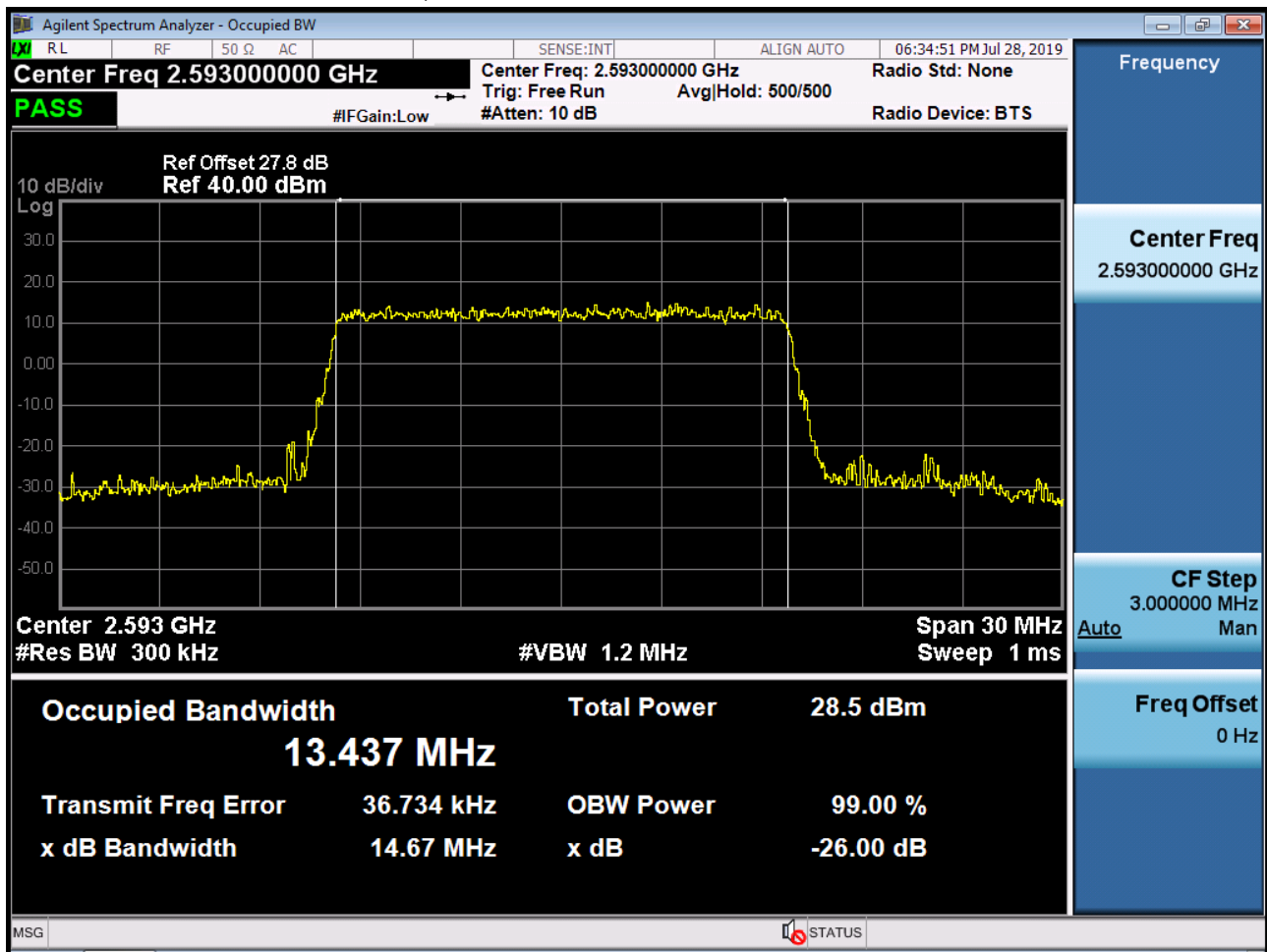
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75)



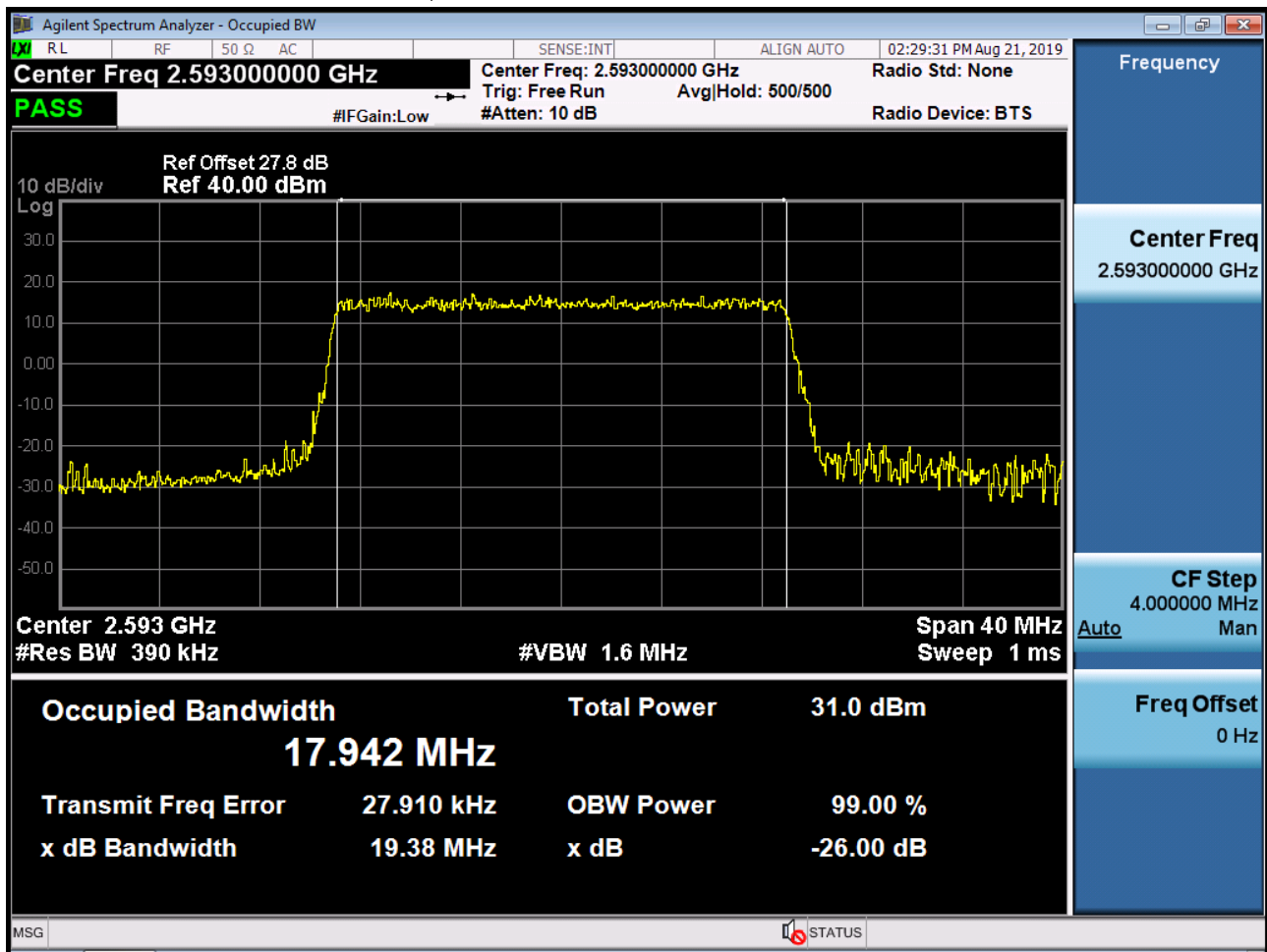
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)



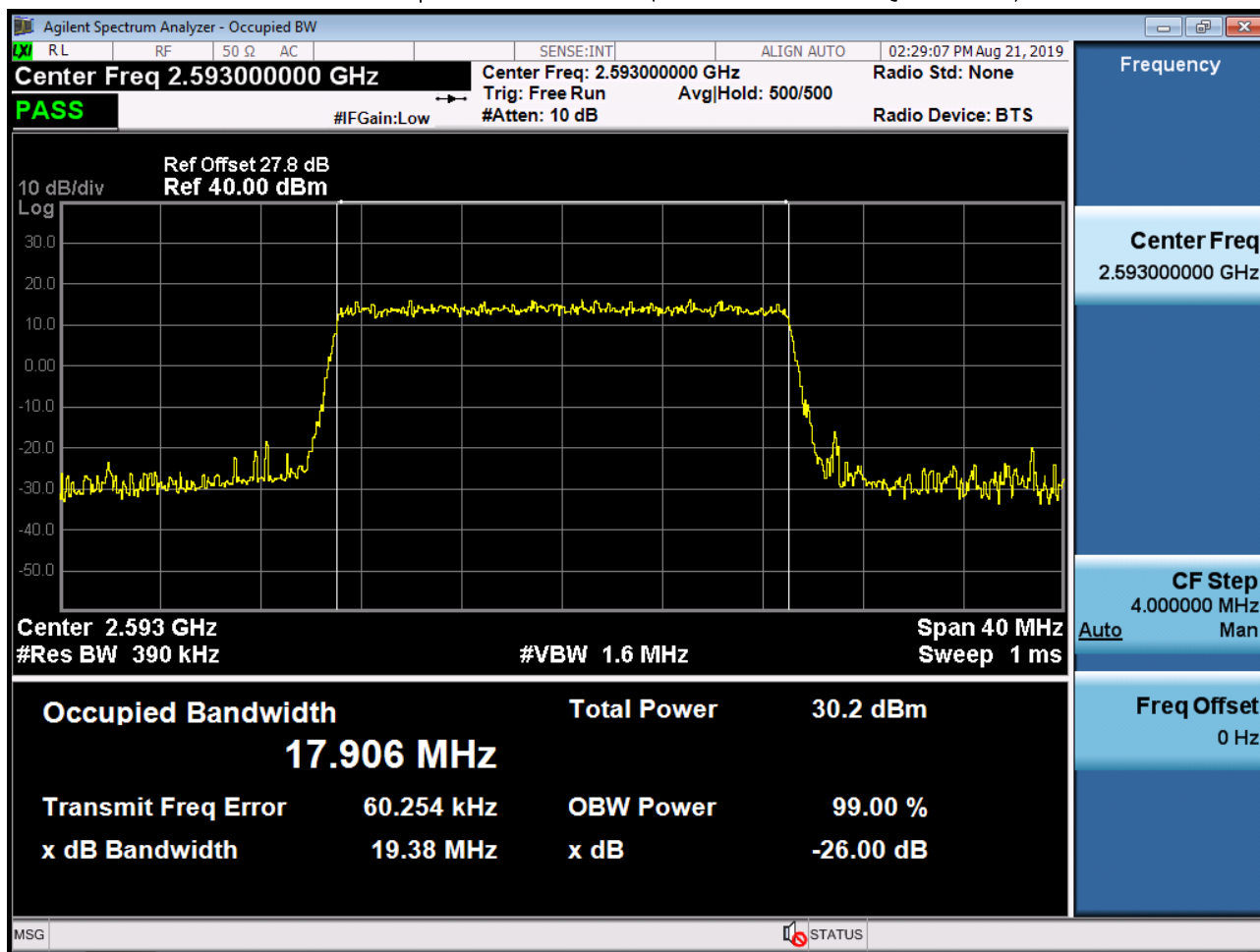
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 64-QAM RB 75)



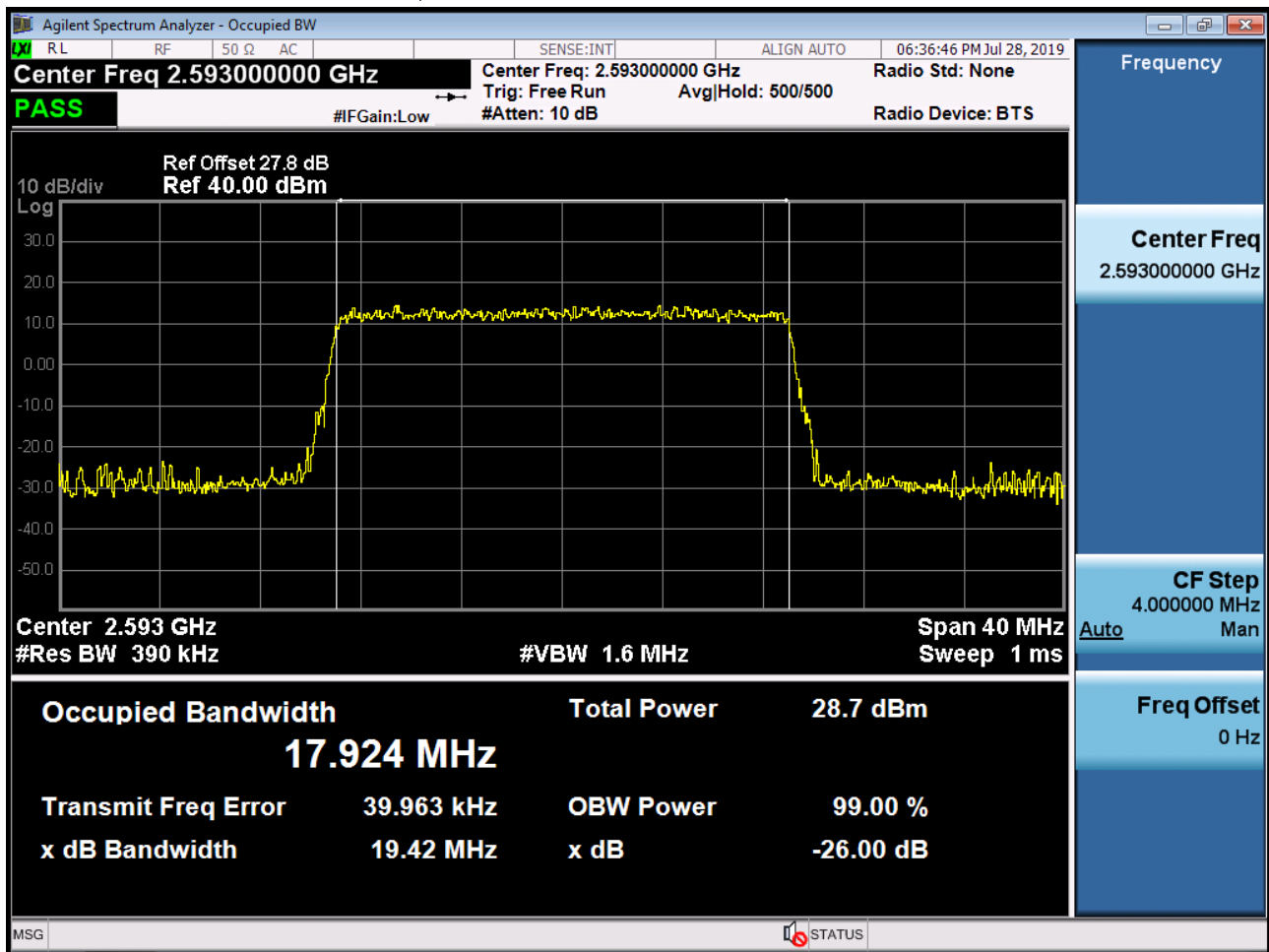
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)



BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100)



BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 64-QAM RB 100)



BAND 41. PAR Plot (5M BW_Ch.40620_QPSK_RB25_0)

